Participation in Design and Acceptance Reviews

NT/Flight Equipment Division

September 5, 2001
Revision A

Verify that this is the correct version before use

National Aeronautics and Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

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September 05, 2001

Approved by

Original Signed by
Vincent D. Watkins
Government Furnished Equipment Branch Chief

Change Record

Revision	Date	Originator/Phone	Description
Baseline	08/01/1996	Rod C. Toler 244-1787	Baseline Release
A	11/12/1997	Rod C. Toler 244-1787	• Added definitions. • Added reference document. • Clarified section 9.1.
	04/07/1998	Rod C. Toler 244-1787	Added Responsibilities section 9. Added section 10.1.c: use of JF 1491 form.
Re-baselined as NT3-PQE-002	04/07/1998	NT MLC	Administrative Change: Work Instruction baselined as a new document with the following changes as a result of SR&QA Reorganization 3/2/98: • Number changed from ND-QE-002, Revision A to NT3-PQE-002 Baseline. • New signature obtained • Text changed to reflect new SR&QA organization structure and responsibilities.
Baseline	04/07/1998	Rod C. Toler 244-1787	Baseline Release
PCN-1	10/23/1998	NT MLC	Editorial Change by NT Master List Custodian to move JF 1491 from Section 4.1, Quality Records, to Section 4.2, Forms and Other Records on page 4.
A	01/20/1999	Rod C. Toler 244-1787	Removed references to JSC 16081 and replaced with references to Appendix A and Appendix B (See change bars). Added additional definitions to section 3.0. Added Appendix A and Appendix B.
PCN-1	02/01/1999	NT MLC	Corrected WI title in header on page 2 - 18.

Revision	Date	Originator/Phone	Description
PQE-002 Baseline	07/24/2000	NT MLC	Baseline Release • This procedure replaces the previous NT Work instruction for this task and has been numbered as such. (See the *NT Handbooks Procedure Numbering Matrix* for more information: http://wwwsrqa.jsc.nasa.gov/iso9000/nt/Numbering-Matrix) Note: Technical changes have not been made during this data restructure unless otherwise noted in this change record.
PCN-1	01/15/2001	NT MLC	• Removed from handbook configuration and returned to individual UWI template. • Branch removed from WI number for portability.
B	09/05/2001	Rod C. Toler 244-1787	Section 6: • Added reference to JSC Safety Manual Section 10: • Paragraphs 10.1.a, c, d, e, f: editorial changes. Appendix A: • Paragraph 2.0: editorial changes • Paragraph 4.0: editorial changes and added informational note tying TRR and JPG 1700.1 together. • Paragraph 6.0: editorial changes Appendix B: • Editorial changes to checklists.

1 PURPOSE

This procedure defines the requirements and responsibilities for the participation of Flight Equipment Division (FED) Government Furnished Equipment (GFE) Branch Quality Engineering personnel in design and acceptance reviews.

2 SCOPE

This procedure is applicable to all JSC preliminary requirements reviews, preliminary design reviews, critical design reviews, acceptance reviews and other designated reviews for flight and flight-like GFE articles and Type II (as defined in NSTS 07700, volume IV) Ground Support Equipment (GSE).

3 DEFINITIONS

GSE: Ground-based equipment identified or functionally designed to support flight and flight-like hardware servicing, checkout, test, movement, alignment, protection, or calibration.

Type II GSE: Any GSE designed for use at NASA manufacturing, development, and test sites that interfaces directly (mechanically or electrically) with flight and flight-like hardware.

Preliminary Design Review (PDR): A formal technical survey of the proposed design approach for an end item, which is performed when the detailed design phase is 10 percent complete to assure that the engineering approach is acceptable.

Critical Design Review (CDR): A formal technical survey of the detailed designed for an end item, which is performed when the design phase is 90 percent complete to assure continued compliance with the engineering approach.

Flight Readiness Review (FRR): A survey of pertinent data to assess the readiness of hardware to satisfactorily complete its intended function during its planned mission.

Acceptance Review (AR): A survey of pertinent data to assess the readiness of hardware for shipment and/or acceptance.

Test Readiness Review (TRR): A survey of pertinent data to assess the readiness of hardware for a major test.

Review Item Disposition (RID): A preprinted form (JF 1491) used to document deficiencies related to particular reviews. The form provides for description, recommendations for resolution, and response. Generally, a RID is written to document a hardware problem, but may be written to document items deemed noteworthy to the review board.

4 QUALITY RECORDS AND FORMS

4.1 Quality Records

None

4.2 Forms and Other Records

JF 1491, *Review Item Disposition (RID) Orbiter/Shuttle*
JF 1850, *Test Readiness Review Summary Sheet*
DD Form 250, *Material Inspection and Receiving Report*

5 SAFETY PRECAUTIONS AND WARNING NOTES

None

6 REFERENCES

NSTS 07700, *National Space Transportation System Program Definition and Requirements*
JPG 1700.1, *JSC Safety and Health Handbook*

7 TOOLS, EQUIPMENT, AND MATERIALS

None

8 PERSONNEL TRAINING AND CERTIFICATION

None

9 RESPONSIBILITIES

9.1 Program/Project Office: Design and hardware milestone reviews shall be scheduled by the program or project office responsible for the hardware being developed. The office defines the purpose and scope of the reviews, outlines review procedures, establishes review boards, and establishes responsibilities for planning activities, data review, and board participation.

9.2 Quality Engineer: The quality engineer has the prime responsibility for GFE acceptance reviews.

9.3 Safety and Mission Assurance Engineer: The S&MA engineer has prime responsibility for Safety and Reliability for GFE design and is supported, as required, by the quality engineer.

10 PROCEDURE

10.1 Instructions:

a. Acceptance reviews shall be performed to establish the product/system configuration baseline, to assure compliance with documented requirements, and assess the readiness of the product/system for acceptance, shipment, and/or flight.

b. Milestone reviews are not mandatory for Type II GSE, however, if any milestone reviews are requested by the design organization, the review shall be consistent with the requirements of this procedure.

c. GFE Branch Quality Engineering participants in design reviews shall use the procedures and checklists provided in Appendix A and Appendix B as guidelines and shall use the JSC Form JF 1491 to document findings as described in Appendix A.

d. The GFE Branch Quality Engineer shall assure that the reviews are conducted and completed by the appropriate discipline (Engineering, Safety and Mission Assurance, Test Safety, or Quality Engineering) in accordance with the guidelines in Appendix A and checklists in Appendix B to assure program requirements are met..

e. GFE Branch Quality Engineering design review activities shall ensure that designs permit and facilitate repeatability, inspectability, and maintainability.

f. GFE Branch Quality Engineering personnel participating in acceptance reviews shall conduct them in accordance with the guidelines in Appendix A and Appendix B, and accomplish the following:

1. Evaluation of the test/checkout operations and results including anomalies, failure histories, remedial actions, and recurrence control and/or preventative actions.
2. Assessment of as-designed versus as-built configuration and rationale for the differences including identification and verification of approval of waivers and/or deviations to the design requirements.
3. Identification of limited life components and their remaining life.
4. Identification and status of open items including shortages, nonconformances, unincorporated engineering changes, incomplete or open tests, constraints to further processing or use.
5. Evaluation and review of acceptance test records including the test procedure, deviations, and test records.

11 FLOW DIAGRAM

None

APPENDIX A

1.0 Applicability. This appendix is applicable to PDRs, CDRs, TRRs, and ARs.

2.0 PDR General Information.

a. Purpose of the PDR. The purposes of the PDR are to approve the design concept and to authorize the detailed design effort. It is intended to insure that the proposed design satisfies established requirements, within existing technologies and that adequate manufacturing, test equipment, and facilities are available.

b. Evaluation of the Design. As a minimum, the PDR shall include evaluation of the design concept with decisions based on the following considerations:

1. Compliance with contractor statement of work, end item specifications, specific design criteria, and other applicable requirements.
2. Compatibility with interface and operational requirements.
3. Feasibility of proposed schedule.
4. Consideration of induced and natural environmental criteria.
5. Requirements for transporting, storing, handling, and GSE.
6. Inclusion of reliability, quality, safety, and human factors requirements.
7. Ease of manufacturing and manufacturing requirements.
8. Generation, approval, revision, retention, and retrieval of adequate documentation and data.
9. Concept adequacy to satisfy thermal, electrical, mechanical, and performance requirements.
10. Ease of inspection and testing.

c. PDR Schedule. A PDR is held early in the design phase, usually when the design effort is about 10 percent complete, on an established date which is a recognized milestone. The pre-review of data begins 2 to 4 weeks prior to the formal PDR date.

d. Products of the PDR. The products of the PDR are approval of the design plans and specifications, including amendments authorized by the review board, and authorization to proceed with the detailed design effort.

3.0 CDR GENERAL INFORMATION.

a. Purpose of the CDR. The general purpose of the CDR is to approve the detailed design and to authorize final release to production. Particular emphasis will be placed on assessing the design to insure that it satisfies established requirements and specifications, including those established by the PDR. The CDR also insures that the detailed design and implementing procedures are within the state-of-the art for manufacturing.

b. Evaluation of the Design. As a minimum, the CDR shall include evaluation of the detai1ed design with decisions based on the considerations listed for the PDR plus the following considerations:

1. Detailed environmental, thermal, electrical, and mechanical analyses.
2. development test data.

3. Trade-off studies.
4. Requirements which have been added or changed since the PDR
5. Parts and materials selection.
6. Manufacturing and test plans and procedures. Ease of manufacturing, inspection, and testing.
7. Completion of actions generated at the PDR

c. CDR Schedule. The CDR is held prior to the release of the design to manufacturing, usually when the detailed design is about 90 percent complete.

d. Products of the CDR. The products of the CDR are the approval of the detailed design, as modified by the design review board, and the authorization to release to manufacturing.

4.0 GFE TRR General Information.

a. Purpose of the GFE TRR. The purpose of the GFE TRR is to verify GFE (test article), facility and GSE as-built versus as designed configuration; adequacy of test parameters, procedures, setup, test (red line) limitations, test and facility hazards and controls; and qualifications of test personnel. (Note: A TRR **MUST** be conducted for all tests which meet the criteria for being designated as hazardous per JPG 1700.1, Chapters 109 and 309).

b. Documentation Review. As a minimum, the TRR shall include review of GFE test article and test facility documentation to identify differences between as-built and as designed configuration, pending work, incomplete documentation, hazard analyses, open issues and concerns; verify adequacy of test procedure according to test plan/ requirements, test article/test equipment interfaces; test article, facility, and personnel protection.

c. TRR Schedule. The TRR is conducted prior to start of test and the schedule allows sufficient time to permit resolution of issues/concerns that are identified during documentation review.

d. Products of TRR. The products of the TRR are test readiness review summary sheet (JF 1850), adequate resolution of issues/concerns and statement of test readiness and authorization to commence tests.

5.0 Acceptance Review General Information

a. Purpose of the GFE AR. The AR is a formal technical review which establishes the product configuration base1ine. The AR is the primary assurance to the customer that he is receiving the product he specified.

b. Tasks of the Review. The general tasks of the AR are as fol1ows:
1. To determine the compatibility between released engineering and as-built configuration.
2. To determine the compatibility between qualified configuration and as-built configuration.
3. To determine the validity of acceptance testing by comparison of test method and test data with the unit's performance as specified by design requirements.

c. Product of the AR. The most significant data output from the AR is the "Material Inspection and Receiving Report", DD Form 250, or an equivalent, constituting customer acceptance of the end item. The review insures that the documentation in the Acceptance Data Package (ADP) correctly identifies the end item configuration.

6.0 CHECKLIST. The attached checklist in Appendix B will be used as a guideline for Quality Engineering responsibilities for and participation in GFE PDRs, CDRs, and ARs.

APPENDIX B

Quality Engineering Milestone Review Checklists

Quality Engineers are to complete the attached checklists in this appendix during the review. Be sure to specify the type of review (PDR/CDR/TRR/AR) and complete items as applicable. The checklists are used as guidelines to insure that review responsibilities have been satisfied. These checklists are to be maintained on file by the quality engineer. The quality engineering design review worksheet is used to document data reviewed in support of completing the quality engineering design review checklist.

Appendix B contd.

MILESTONE REVIEW CHECKLIST FOR GFE (PDR'S/CDR'S/TRR'S/AR'S)

General. Quality Engineering evaluators are to complete the attached checklist during the review. Specify the type of review *(*PDR, CDR, TRR, AR) and complete items as applicable

The checklist is used as a guideline to insure that review requirements have been satisfied.

Check the applicable column. Explain quality engineering concerns in the "Remarks" column. Open (unresolved) issues will be recorded on RIDs (JF 1491) and RID tracking numbers will be noted in the "Remarks" column of the checklist. Where less than 100 percent of the task was performed, indicate exactly what was accomplished.

The quality engineering evaluators shall evaluate the design and end items based on the PDR/CDR/TRR/AR guidelines, and the contract statement of work. Indicate N/A in the "Remarks" column for items that are not applicable to the specific review. (Refer to matrix for review item applicability.)

CHECK TYPE OF REVIEW:

☐ Preliminary Design Review

☐ Critical Design Review

☐ Test Readiness Review

☐ Acceptance Review

☐ Other

PART NOMENCLATURE	PART NUMBER	PART SERIAL NUMBER

CONTRACT NUMBER	SUPPLIER NAME

Appendix B contd: Quality Engineering GFE Review Checklist

	Checklist Item	Yes	No	Remarks and Comments
1.	Are Quality program plans acceptable? Evaluate changes since last review.			
2.	Are all quality engineering action items and open RIDs from previous reviews satisfactorily closed? Identify open items.			
3.	Are applicable Program design and procedural standards identified in the design and implementation documents?			
4.	Are drawings complete, tolerances adequate and characteristics measurable? Verify interface characteristics.			
5.	Verify adequacy of configuration control			
6.	Do specifications define controls for contamination, wiring, plumbing, structures and pressure vessels? Verify that controls begin with procurements and continue until Government acceptance of the end item.			
7.	Have all engineering changes been incorporated and changes approved by CCB actions?			
8.	Are all required waivers/deviations identified and acceptable? Identify un-approved waivers.			
9.	Are Failure Modes and Effects Analyses (FMEA), Critical Items Lists (CIL), and Single Failure Points (SFP) identified, controlled, and acceptable? Evaluate redundancy of critical functions.			
10.	Are special and critical processes identified and controlled by specifications or procedures?			
11.	Are procurement, manufacturing, assembly, and test inspection plans/procedures complete?			
12.	Are procurement controls, and supplier surveys defined, controlled, and documented?			

Appendix B contd: Quality Engineering GFE Review Checklist

	Checklist Item	Yes	No	Remarks and Comments
13.	Are controls for non-conforming materials including fai1ures, ALERTS, analysis, and corrective action adequate? Review open/ closed discrepancy reports for status and adequacy of close-out rationale.			
14.	Do specifications and as-built configuration records indicate compatibility and repeatability between design, manu-facturing, test, and inspection?			
15.	Is metrology program adequately documented and controlled? Evaluate recall system.			
16.	Are test plans, procedures, criteria, test methods equipment and controls complete and adequate? Are Mandatory Inspection Points (MIP) identified? Evaluate sampling plans. Are retest requirements identified and complete?			
17.	Do installed serialized parts agree with those identified on the serialized parts list and is the list current?			
18.	Are time/cycle and age/shelf life sensitive items identified and controlled? Are the remaining time/cycles adequate to support program schedules?			
19.	Has reuse of previously flown or test hardware been authorized for flight by NASA?			
20.	Pressure Systems (as applicable) a. Have systems been damaged because of out-of-tolerance conditions? b. Have proper safety precautions been included? Have pressure vessels/systems been qualified and certified?			
21.	RFI/EMI Electrical Transients Has hardware been tested/evaluated for emitted/conductive EMI characteristics?			

Appendix B contd: Quality Engineering GFE Review Checklist

	Checklist Item	Yes	No	Remarks and Comments
22.	Safety Analysis Report (SAR) a. Does the Hazard Analysis (HA) for each subsystem include the complete identification of hazards and their causes and effects on personnel, equipment, objectives and/or mission; and rationale to eliminate or control hazard? b. Is acceptance rationale adequate for residual hazards? c. For TRR Only: Was Test Safety Officer involved in review of HA (facility and test article)?			
23.	Crew Safety Concerns a. Are flammable, shatterable, radioactive, and toxic materials identified and are rationale for use adequate? b. Have all sharp corners, edges, protrusions, and excessive cold-heat-emitting devices been eliminated or insulated against crew access? c. Are electrical devices, circuits, and pressure systems protected against overload, detonation, and outgassing? d. Are control devices adequately identi-fied, protected, and separated to prevent inadvertent activation?			
24.	Is all flight hardware certified?			
25.	Are end item ADP's complete according to requirements? Are open items identified, including “remove/install before flight items”?			
26.	Review unique GSE as required.			

Use additional sheets for additional comments.

Sign assessment statements and identify open issues and exceptions.

Quality Engineering Evaluator

Date:

Appendix B contd.

Note: Refer to the matrix below for determining review criteria applicable to a specific milestone and responsibility for accomplishing the review.

Applicability Of Checklist Criteria At Appropriate Milestone Review

Checklist Item Number	Milestone			
	PDR	CDR	TRR	AR
1.	X	X		
2.		X	X	X
3.	X	X		
4.	X	X	X	
5.		X	X	X
6.	X	X	X	X
7.			X	X
8.	X	X	X	X
9.		X		
10.	X	X		
11.		X	X	X
12.	X	X		
13.		X	X	X
14.		X	X	X
15.		X	X	X
16.		X	X	X
17.		X		X
18.		X	X	X
19.		X		X
20.		X	X	X
21.		X		X
22.		X	X	
23.		X	X	X
24.				X
25.			X	X
26.		X	X	X

Appendix B contd.

Quality Engineering Design Review Checklist

	Action	Accomplished? (Ö)
1.	Review dispositions of QA action items resulting from previous NASA reviews and visits.	
2.	Review quality program (updates and changes).	
3.	Review drawings for (a) completeness, (b) measurability of characteristics, (c) validity of tolerance buildup, (e) materials, (f) callout of process specs, and (g) implementation of applicable Program Design Standards.	
4.	Review plans for control and verification of configuration changes.	
5.	Review manufacturing, test, and acceptance plans from the standpoint of insuring adequate details of planning and inspection requirements.	
6.	Review system for identifying and tracking limited life items.	
7.	Review adequacy of items selected for traceability.	
8.	Assess adequacy of process specifications, including contamination control, wiring, plumbing, and pressure vessels	
9.	Review inspection plans. Review inspection and test methods (including specific test and inspection equipment, environmental controls, and the use of sampling plans). If MIP's are identified, insure that they cover critical characteristics on the drawings.	
10.	Review plans for failure reporting and corrective action.	

Check One (√)

☐ Preliminary Design Review ☐ Critical Design Review

End Item Name End Item Part Number

_____ _____

_____ _____

Quality Engineer Date:

Appendix B contd.

Quality Engineering Design Review Worksheet

	Review Item	Reviewed (√)	Comments
1.	Quality Program Plan		
2.	Reliability Program Plan		
3.	Drawings		
4.	Process Specifications		
5.	Manufacturing Plan		
6.	Test Plan		
7.	Acceptance Plan		
8.	Inspection Plan		
9.	Configuration Control Plan		
10.	Limited Life Items		
11.	Traceability Items		
12.	Manufacturing Planning Document		
13.	Test Planning Documents		
14.	Inspection Planning Documents		
15.	Mandatory Inspection Points		